

THE MASSACHUSETTS SOCIETY FOR
PROMOTING AGRICULTURE ASKS
YOUR ACTIVE INFLUENCE TO SUP-
PRESS THESE INSECT PESTS.

HATCH EXPERIMENT STATION

—OF THE—

MASSACHUSETTS

AGRICULTURAL COLLEGE.

BULLETIN No. 20.

REPORT ON INSECTS.

JANUARY, 1893.

The Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same.

AMHERST, MASS. :
PRESS OF CARPENTER & MOREHOUSE.
1893.

HATCH EXPERIMENT STATION

OF THE

MASSACHUSETTS AGRICULTURAL COLLEGE.

AMHERST, MASS.

At the organization of the Experiment Station of the Massachusetts Agricultural College under the provisions of the Hatch Bill, it was decided to name it the "Hatch Experiment Station of the Massachusetts Agricultural College," in order to distinguish it from the State Agricultural Experiment Station, already located on the college grounds, but having no connection with it.

Its officers are :—

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The coöperation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly in agriculture, are earnestly requested. Communications may be addressed to the
Hatch Experiment Station,
Amherst, Mass.

Division of Entomology.

C. H. FERNALD.

The insects treated of in this bulletin have been selected at the request of the Massachusetts Society for Promoting Agriculture, by whose liberality the edition has been increased to more than threetimes as many copies as could otherwise have been published; and, as a result, it will be sent to thousands of our citizens whose names are not now on our mailing list, including members of Village Improvement and other local societies.

These insects have been bred and experimented upon at the Insectary for several years past, and they have been described in the publications of the Department of Agriculture and some of the Experiment Stations, as well as elsewhere, so that it is now almost impossible to give anything new, but we have attempted to give a brief digest of what has been learned of their habits here and elsewhere.

There has been such culpable negligence on the part of many of our people with regard to the tent caterpillar, that there can be no doubt that some legislation is needed to compel the negligent to destroy this pest on all the trees on their own land, and thus prevent it from extending to the trees in the surrounding orchards. Provision should be made for the destruction of tent caterpillars on all public lands as well as in the forests, and village improvement societies should urge such action in town meetings as shall make it the duty of the superintendent of roads to destroy all the tent caterpillars on the trees and shrubs along the sides of the roads.

The wild cherry trees are the natural food plant of the tent caterpillar, and while some advocate their destruction because they serve as a breeding place for them, others think they may serve a useful purpose in drawing the moths to them where the caterpillars may be easily destroyed the following year.

CANKER-WORMS.

There are two different species of insects in Massachusetts known by the name of canker-worm, one of which is the spring canker-worm, (*Paleacrita vernata*, Peck.) Figs. 1 and 2, and the other is the fall canker-worm (*Anisopteryx pometaria* Harr.) Figs. 3 and 4.

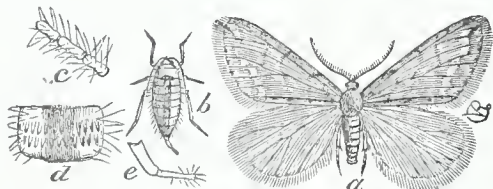


FIG. 1. SPRING CANKER-WORM.

a, Male moth; *b*, female moth, natural size; *c*, joints of her antennae; *d*, joint of her abdomen showing the spigues; *e*, her ovipositor, enlarged.—After Riley.

The spring canker-worms emerge from the ground as soon as the snow is gone or even earlier in the spring. The wingless females, Fig. 1, *b*, crawl up the trunks of trees most actively in the evening when they pair with the males, Fig. 1, *a*, which are flying about at that time. The females then crawl out upon the branches and deposit their eggs in irregular clusters, in the crevices or under loose pieces of bark, by means of the long ovipositor, Fig. 1, *e*.

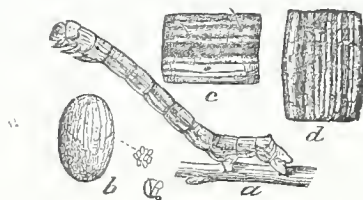


FIG. 2. SPRING CANKER-WORM.

a, Full-grown larva; *b*, egg, enlarged, the natural size shown in the small mass at one side; *c*, an enlarged joint, side view; *d*, the same, back view, showing the markings.—After Riley.

The eggs, Fig. 2, *b*, natural size and enlarged, are oval in outline, about one-thirtieth of an inch long, of a delicate pearly yellowish color, and hatch about the time the leaves burst from the buds.

The larvae or young caterpillars have three pairs of true legs, situated on the three segments following the head, and two pairs of abdominal legs, and therefore move by alternately looping and extending their bodies, and are known as loop-worms, inch-worms, or measuring-worms. When fully grown they are from seven-tenths

to eight-tenths of an inch in length, of a dark brown color, with five broken lines of a lighter color running lengthwise, Fig. 2, *a*.

At this time, and even while small, they often let themselves down from the trees by a silken thread and hang suspended in the air, much to the annoyance of persons passing under the trees. They are also caught by passing vehicles and carried to places more or less remote, thus greatly facilitating their distribution.

After they are fully grown and done feeding, they descend to the ground and burrow to the depth of three inches or more, where they spin a fragile cocoon of dull yellowish silk within which they transform to pupae, and remain in this state till the following spring, when the moths emerge, ascend the trees and lay their eggs for another generation. A few of the individuals, however, emerge in the fall and lay their eggs, but these do not hatch till the following spring.

The male, Fig. 1, *a*, is of a pale ash color with a paler broken band across the fore wings, near the outer margin, and three interrupted brownish lines between that and the base. The hind wings are of a very pale ash color or very light gray, with a darker dot near the middle. The female, Fig. 2, *b*, is wingless and of the same color as the male.

The fall canker-worms (*Anisopteryx pomataria*, Harr.) emerge from the ground late in the fall, after the leaves have fallen from the trees and frosts have appeared. The females climb the trees attended by the males which hover around on the wing. After the mating of the moths, the females lay their eggs side by side in regular masses, Fig. 3, *e*, often as many as a hundred together, in an exposed situation on the twigs or branches of the trees. Sometimes the females, by mistake, crawl up on the side of a building and deposit their clusters of eggs on the exposed surface.

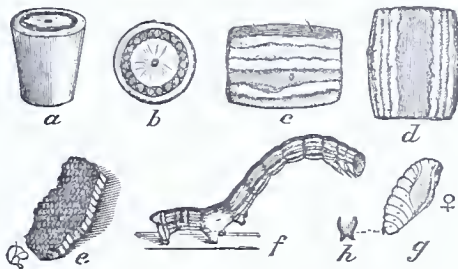


FIG. 3. FALL CANKER-WORM.

a, *b*, Egg, side and top views; *c*, *d*, joints of larvae, side and top views, showing markings, enlarged; *e*, cluster of eggs; *f*, full grown larva; *g*, female pupa, natural size; *h*, cremaster enlarged.—After Riley.

The eggs are in the form of a truncated cone, and attached by the smaller end, while the other end has a dark rim with a depressed center, Fig. 3, *a* and *b*. These hatch in the spring at about the same time as the other species, and the larvae have similar habits to those of the spring species.

The mature larvae are nearly an inch long, varying in color from a greenish yellow to dark brown, with pale stripes running lengthwise; and they differ from the other species still further in having three pairs of abdominal legs, Fig. 3, *f*. After they are done feeding, they descend from the trees and burrow into the ground where they pass their transformations, and the moths emerge late in the fall.

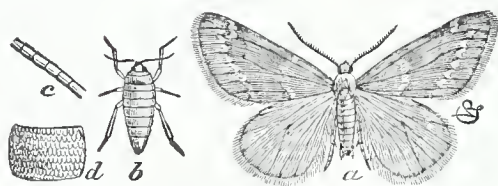


FIG. 4.—FALL CANKER-WORM.

a, Male moth; *b*, female moth, natural size; *c*, joints of her antennae; *d*, joints of her abdomen—enlarged.—After Riley.

The males have well developed wings which expand nearly an inch and a half, and are of a pale gray or ash color. The forewings have two rather irregular whitish bands across them, and the hind wings have a faint blackish dot on the middle and a more or less distinct whitish band outside of it, Fig. 4, *a*. The females are pale gray or ash color and about three-tenths of an inch long, Fig. 4, *b*.

REMEDIES.

As the females are wingless and pass their transformations under ground, and are obliged to crawl up the trunks of the trees to deposit their eggs, one method is to prevent their ascent by putting bands of heavy paper around the trunks, and painting them with some sticky preparation, as printer's ink, or tar softened with oil.

Another method is to put a trap of zinc or tin around the trunks of the trees in such a manner as to prevent the females from ascending the trees. Care must be taken in putting the bands and traps around the trees, to have them fit so tightly that neither the female moth nor the newly-hatched larvae can find a passage beneath.

Probably the most effectual method is to shower the trees with paris green in water as soon as the eggs have hatched in the spring.

THE APPLE-TREE TENT-CATERPILLAR.

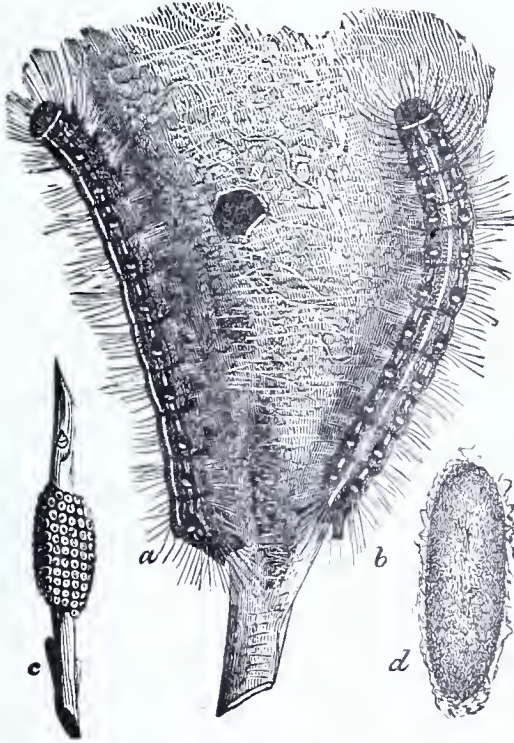
Clisiocampa americana, Harr.

FIG. 5. APPLE-TREE TENT-CATERPILLAR.

a and *b*, full grown caterpillars resting on the tent; *c*, belt of eggs; *d*, cocoon, all natural size.—After Riley.

This species was described in bulletin No. 12, of this Station, and is prepared again with additional facts and illustrations for publication at this time. It has been so very abundant and destructive throughout the Commonwealth for several years past as to attract very general attention. The large whitish, silken, web-like tents, Figs. 5 and 6, *d*, formed by these insects have been very unsightly objects on the fruit trees in our orchards and along the road sides, as well as on wild cherry trees in all our forests where these trees are allowed to grow.

The amount of damage which this insect has done is far greater than is generally supposed.

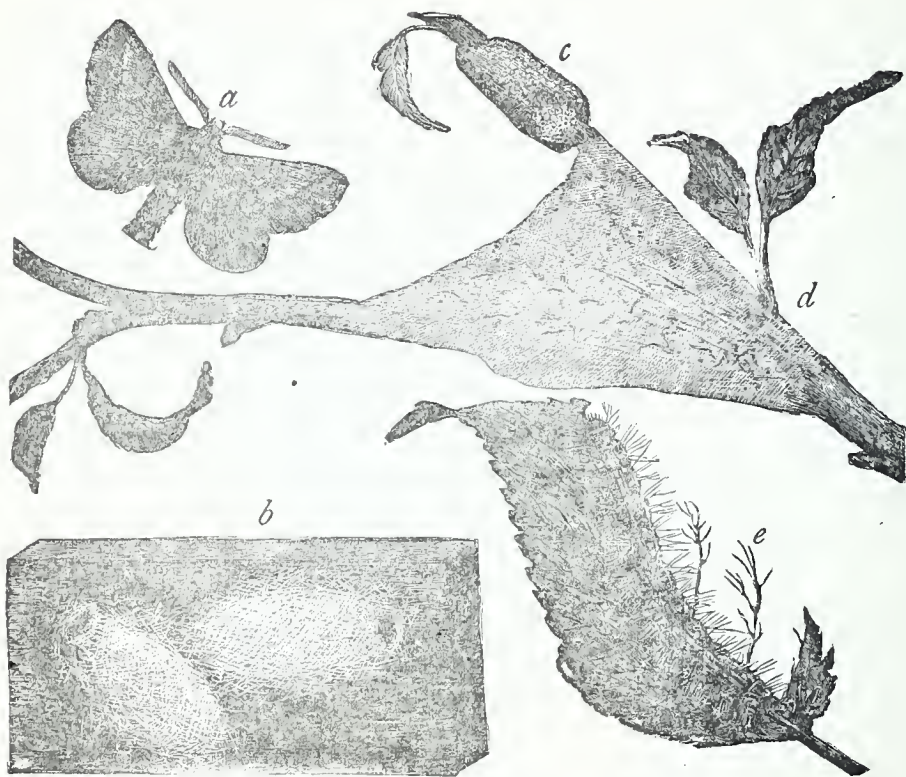


FIG. 6. APPLE-TREE TENT-CATERPILLAR.

a, Male moth; *b*, cocoons; *c*, belt of eggs; *d*, a small tent; *e*, full grown caterpillar,—all natural size.—After Comstock.

The female moth, Fig. 7, lays her eggs, about three hundred in number, in a belt, Fig. 5, *c* and 6, *c*, around the twigs of apple, cherry and several other kinds of trees, covering them with a thick coating of dark brown glutinous matter which probably serves as a protection during the winter.



FIG. 7. APPLE-TREE TENT-CATERPILLAR.

Female moth, natural size.—After Riley.

The following spring, when the buds begin to swell, the eggs hatch and the young caterpillars seek some fork of a branch where they spin their tent and remain when not feeding. They are about one-

tenth of an inch long, of a blackish color, with numerous fine gray hairs on the body. They feed on the young and tender leaves, eating on an average two apiece each day, therefore the young of one pair of moths consume from ten to twelve thousand leaves; and it is not uncommon to see from six to eight tents on a single tree, the caterpillars of which destroy more than seventy-five thousand leaves by the time they cease feeding. They do not go out of their tents to eat in damp cold weather, but appear to take two meals a day when it is pleasant. As the caterpillars grow, they molt or cast off the old skin which splits along the back. In from thirty-five to forty days after hatching, they reach their full growth, Fig. 5, *a* and *b*, Fig. 6, *e*. They are then about two inches long and have a black head and body with numerous yellowish hairs over the surface. There is a white stripe along the middle of the back, with minute whitish or yellowish broken and irregular streaks along the sides, and a row of small, transverse, pale blue spots along each side of the back.

As they crawl about, they spin a continuous thread of silk from a minute fleshy tube, on the lower side of the mouth, which is connected with the silk-producing glands within the body, and by means of this thread they appear to find their way back from the leaves to their tent which is formed by the combined efforts of all the caterpillars in the community.

After reaching their full growth, about the middle of June, they leave their tents and scatter in all directions, seeking some protected place where they spin their spindle-shaped cocoons of whitish silk intermingled with sulphur-colored powder, Figs. 5, *d* and 6, *b*. They change to the pupal state within these cocoons, and remain in them from twenty to twenty-five days. In July the moths emerge and, after mating, the females lay their eggs around the twigs of trees where they remain through the winter and hatch in the early spring, when the buds on the trees begin to open.

The moths measure from one and a quarter to one and a half inches or more between the tips of their expanded wings. They are of a reddish brown color, the fore wings being tinged with gray on the base and middle, and crossed by two oblique whitish stripes, Fig. 6, *a*, male, Fig. 7, female.

REMEDIES.

Search the trees carefully, when they are bare, for clusters of eggs and when found, cut off the twigs to which they are attached and burn them.

As soon as any tents are seen in the orchard or elsewhere, they should be crushed with their entire contents, or swabbed down with strong soapsuds or other substance, or torn down with a round bottle-brush, or burned with a torch on the end of a pole. This work of destroying the caterpillars in their tents should be done early in the morning, late in the afternoon or on a cold wet day when they are all in their tents.

When the trees are infested with canker worms or other leaf-eating insects, as well as tent caterpillars, or when these are numerous, it will be better to spray the trees with paris green in water in the proportion of one pound of the former to 150 to 250 gallons of the latter.

THE FALL WEB-WORM.

Hyphantria cunea, Drury.

This native American insect is very abundant throughout Massachusetts, forming unsightly webs over the ends of the branches of fruit and nearly all other deciduous trees, in August and September, and are supposed by many to be the apple-tree tent-caterpillar, but these form their tents during the early part of the season, in April and May.

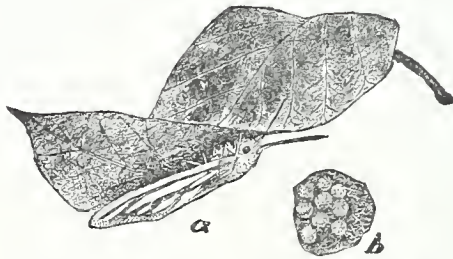


FIG. 8. FALL WEB-WORM.

a, Moth in position on leaf laying eggs, side view; *b*, eggs enlarged.—After Riley.

The moths are on the wing in July, and lay their eggs, about five hundred in number, in clusters on the leaves near the end of a branch, Fig. 8. These eggs, which are spherical, about one-twentieth of an inch in diameter, and of a bright golden yellow color, have the surface of the shell marked with indentations like the surface of a thimble. They hatch in about a week or ten days and the young caterpillars at once spin a web over themselves, and by their combined efforts enclose leaves enough for their present needs, but when

this supply is exhausted they extend their web over a fresh supply, and this is continued till many of these webs are a yard or more in length and a foot or more in diameter. When numerous, they do a great deal of damage, sometimes destroying all the leaves on a tree.

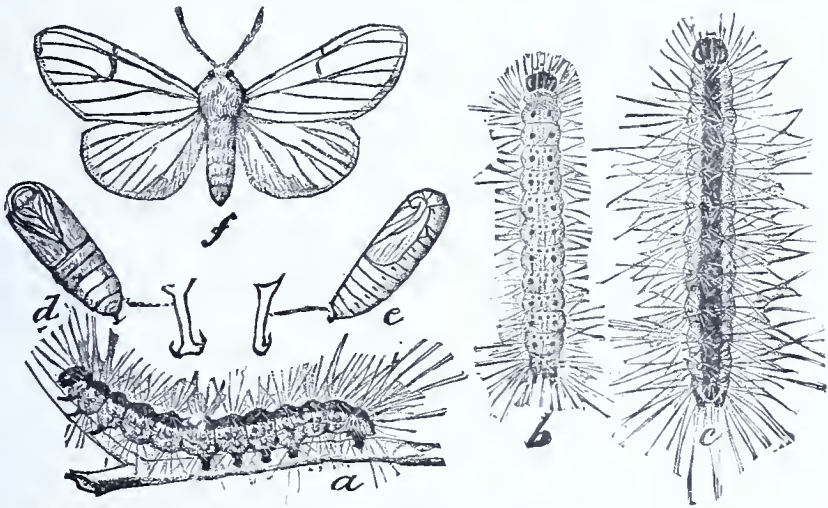


FIG. 9. FALL WEB-WORM.

a, Dark caterpillar, seen from side; *b*, light caterpillar from above; *c*, dark caterpillar from above; *d*, pupa from below; *e*, pupa from side; *f*, moth.—After Riley.

In the latter part of August or early in September, these caterpillars reach their full growth, and are then about an inch and a half long with the body greenish yellow dotted with black. There is a bright yellow stripe along each side, and a broad blackish stripe along the back in some specimens, as shown in Fig. 9, *b*. They are thinly clothed with grayish hairs which arise from black and orange colored tubercles. They now leave their web and scatter in all directions seeking some place in which to change to pupae, usually in some crevice under the bark, or under ground. When they have reached a satisfactory shelter they spin a slight cocoon of silk intermixed with hair from their own bodies, and within these cocoons they transform to pupae, Fig. 9, *d* and *e*, where they remain till the following June or July when the moths emerge. There are said to be two broods in a year in the South but only one in the North. I have seen no satisfactory evidence that there is more than one brood in Massachusetts.

The moths are snow white with the first two joints of the fore legs yellow, and the outer joints of all the legs broadly ringed with black.

The wings expand from an inch and an eighth to an inch and three-eighths. Fig. 9, *f*, represents an unusually large moth of this species. The moths in this State, as a rule, have pure white fore wings, but sometimes, especially further south, they are more or less dotted or spotted with dark brown or black as shown in Fig. 10; *a* to *j*. I have never taken a spotted example in Massachusetts and only one in Maine. Possibly the normal northern form is pure white and the southern form spotted.

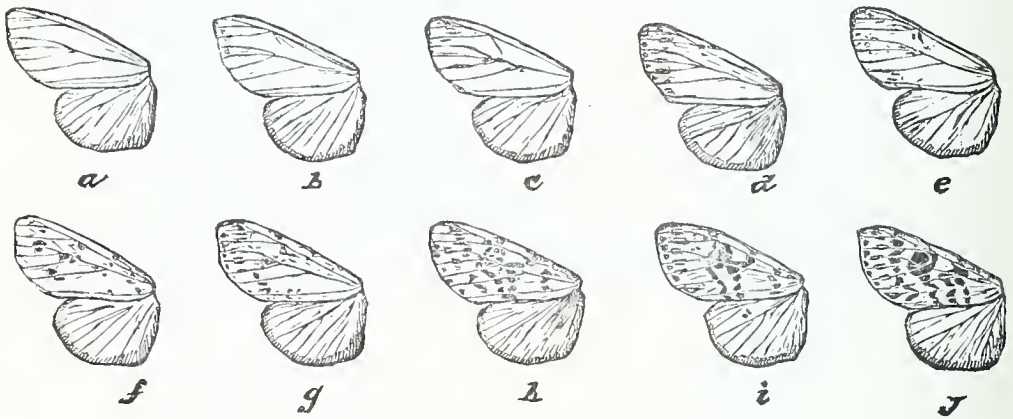


FIG. 10. FALL WEB-WORM.

a-j. Wings of a series of moths, showing the variations from the pure white form to one profusely dotted with black and brown.—After Riley.

The Fall Web-worm has numerous enemies among the birds and predacious and parasitic insects, but even with all these checks, they are numerous enough to do a vast amount of injury, and their unsightly webs are far too numerous on our fruit and ornamental trees.

A series of experiments was made on this insect with paris green at the Insectary the past season, but with negative results. Paris green in water was showered upon a branch having a web on it, but the mixture failed to penetrate the web and wet the enclosed leaves, and only those that ate the leaves outside of the web were killed. I do not see how this method can be really serviceable except when they feed outside of their web. I am of the opinion that the most practical, and at the same time the cheapest way to destroy these insects, is to crush them in the webs when they are within reach, or to cut off the small branches containing the webs with long pruning shears, and burn or crush them.

THE TUSSOCK MOTHS.

There are three different species of Tussock Moths in Massachusetts, the first of which is the most common and is known as the White-marked Tussock-moth (*Orgyia leucostigma*, A. and S.). This insect is a native of this country and was figured and described by Abbot and Smith in 1797. Since that time it has received the attention of nearly all of our entomologists.

The eggs of this species, laid on the cocoon of a female attached to a twig of tulip-tree, was brought to the Insectary, April 22, 1891. They were arranged in an irregular cluster containing about 225 in number and were covered by a white, glistening, frothy substance. The eggs are globular with a slight depression on the top, about one twenty-fifth of an inch in diameter and are yellowish white with a pale brown spot on the top and a ring of the same color around it.

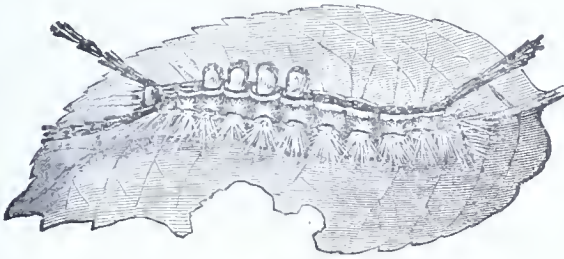


FIG. 11. WHITE-MARKED TUSSOCK-MOTH.

Full grown caterpillar.—After Riley.

These eggs hatched May 10, and the caterpillars passed their molts (the description of which is omitted here) and reached maturity June 15. The full grown caterpillars, Fig. 11, are about an inch and an eighth in length, of a bright yellow color, sparingly clothed with long, fine yellow hairs on the sides of the body, and having four short, thick, brush-like, yellowish tufts on the top of the fifth and the three following segments, two long black plumes or pencils extending forward from the sides of the second segment, and a single plume on the top of the twelfth segment. The head and top of the second segment and also two retractile tubercles on the top of the tenth and eleventh segments are bright red; there is a narrow black or brownish stripe along the top of the back and a wider dusky stripe on each side of the body.

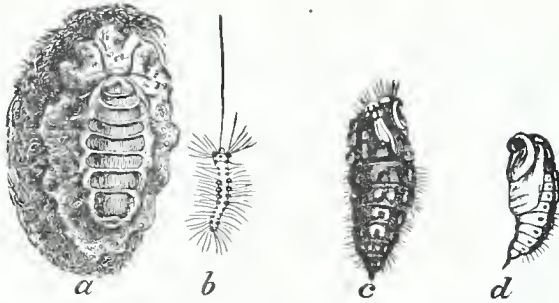


FIG. 12. WHITE-MARKED TUSOCK-MOTH.

a, Female on cocoon; *b*, young caterpillar; *c*, female pupa; *d*, male pupa.—After Riley.

On June 15, they commenced spinning their cocoons and the moths emerged June 21. After mating, the females laid their eggs on the old cocoon which they usually attach to a leaf adhering to a branch of the tree. These eggs of the second generation hatched July 8, passed their transformations, and pupated August 10. The moths of this brood emerged August 23, and laid their eggs which remained through the winter and hatched the next spring, thus giving two generations a year in this State. Fig. 12, *a*, represents the cocoon partially covered with the egg cluster upon which is represented the wingless female moth; *b*, a young caterpillar suspended by a thread; *c*, a female pupa, and *d*, a male pupa.

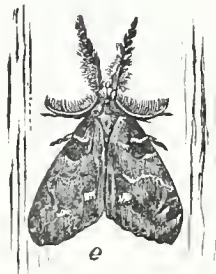


FIG. 13. WHITE-MARKED TUSOCK-MOTH.

Male.—After Riley.

The male, Fig. 13, expands about an inch and a quarter, and is of a dull ashy gray color with several wavy dark brown lines crossing the fore wings which are whitish along the front edge with a small black spot near the apex and a small white spot near the anal angle. The antennae are heavily fringed. The females are lighter gray than the males and have no wings, only the rudiments of them being visible. The body is oval in outline and quite plump before the eggs are laid, Fig. 12, *a*.

This species feeds on the leaves of nearly all deciduous trees, and fir, spruce, larch and cypress.

The second species is called the Willow Tussock Moth (*Orgyia defnita*, Pack.) and was for a long time confounded with the preceding species with which the male and female moths agree very closely, but there are marked differences in the other stages.

The eggs are laid in the fall in clusters on the old cocoon adhering to the branches of trees, and covered with hair from the abdomen of the female, which enables one to distinguish them from the white, froth-covered eggs of the white-marked Tussock-moth or the naked eggs of the following species.

The full grown caterpillar has the head and body pale yellow with an almost colorless stripe along the middle of the back. This stripe is narrow, and greenish on the third and fourth segments, widening and enclosing the yellow, dorsal brush-like tufts on the fifth, sixth, seventh and eighth segments, narrowing on the ninth, tenth, eleventh and twelfth segments, enclosing the two retractile tubercles, and is absent on the last segment. There is a narrow subdorsal and a fainter stigmatal band. These bands vary in color from dark brown to black, and there is a velvety-black spot between the tufts on the top of the sixth, seventh and eighth segments. The tubercles are all pale yellow, and a long pencil of black hairs inclining forward arises from each side of the second segment, while a similar one of light brown and black hair inclines backward from the top of the twelfth segment. The other hair is long, thin and white.

This species feeds on the leaves of the willow, oak, maple and many other trees.

The third species of Tussock Moth is the common European *Orgyia antiqua*, Linn. This species has long been known in this country, but was supposed to be distinct and was described by Dr. Fitch as the Modern Vaporier Moth (*Orgyia nova*), and again by Mr. Henry Edwards from Californian specimens as *Orgyia badia*.

The female is wingless like the other species, and lays her eggs without any covering on the old cocoon which is fastened to the branch of a tree. A cluster of these eggs was received from Fitchburg, Mass., April 14, 1891, on a branch of quince, and began to hatch April 22. The caterpillars reached their full growth and began to spin cocoons June 15. The first moths emerged June 25, and eggs were laid July 5, which hatched on the 15, but the caterpillars

died before reaching maturity. Whether there are more than two broods in this State I am unable to say.

The detailed descriptions of the various stages of these moths have been omitted as they would have but little interest for those for whom this bulletin was especially prepared.

This insect is said to feed in Europe on plum, apple, mountain ash, rose, apricot, raspberry, bilberry, heath, hornbeam, hazelnut, alder, willow, beech, birch, oak, pine and many other plants.

In this country it has been found feeding on the leaves of rose, plum, apple, quince, thorn, aspen, and birch.

REMEDIES.

As these three Tussock Moths are so similar in their general habits they may be dealt with alike. They all pass the winter in the egg stage on the old cocoons fastened to the branches of the trees, and are easily seen during the fall, winter and spring while the trees are bare when they may be removed and destroyed. If, however, they have been neglected and allowed to hatch, the caterpillars may be destroyed by spraying the trees with paris green in water, in the proportion of one pound of the former to 150 or 200 gallons of the latter.